UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/810,928	03/15/2001	Juro Kikuchi	SP01-047 (COR20 P-368)	7134

7590 09/04/2003

Michael R. Long
Price, Heneveld, Cooper, DeWitt & Litton
695 Kenmoor S.E.
P.O. Box 2567
Grand Rapids, MI 49501

EXAMINER
SONG, SARAH U

ART UNIT	PAPER NUMBER
2874	

DATE MAILED: 09/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/810,928	KIKUCHI ET AL.	
	Examiner	Art Unit	
	Sarah Song	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-80* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-80* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 March 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *0902* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

1. The prior art documents submitted by the applicant in the Information Disclosure Statement filed on September 26, 2002 have all been considered and made of record (note the attached copy of form PTO-1449).

Drawings

2. This application has been filed with seventeen (17) sheets of drawings, which have been approved by the Examiner.

Claim Objections

3. Claims 73 and 77 are objected to because of the following informalities: in claim 73 and in claim 77, line 11, examiner believes that "where" should be changed to –wherein--; claim 77 is further objected to for claiming "at least one of an in-line optical device or a waveguide is coupled *in between* one of the second plurality of individual optical fibers and one of the first plurality of individual optical fibers; however, neither the specification nor the figures disclose an in-line optical device or waveguide coupled *in between* the first and second plurality of optical fibers. For purposes of examination, claim 77 will be interpreted according to Figure 11. Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1-11, 14-20, 24, 29, 32, 33, 35, 36-47, 50-56, 60, 65, 68, 69 and 71-73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. (U.S. Patent 6,012,852) in view of Pan (U.S. Patent 5,706,371).** Kadar-Kallen et al. discloses an arrayed in-line optical device comprising a first optical fiber collimator array, including: a first optical fiber array block 1 configured to receive and retain a first plurality of individual optical fibers 8 which carry optical signals, the first optical fiber array block including a first block surface 4; and a first microlens array substrate 5 coupled to the first optical fiber array block 1, the first microlens array substrate including a first plurality of microlenses 6 integrated along a first microlens surface and a first substrate surface opposite the first microlens surface (inherent), wherein the optical signals from the first plurality of individual optical fibers are each collimated by a different one of the first plurality of integrated microlenses; a second optical fiber collimator array, including: a second optical fiber array block 11 configured to receive and retain a second plurality of individual optical fibers which carry the optical signals, the second optical fiber array block including a second block surface 14; and a second microlens array substrate 15 coupled to the second optical fiber array block, the second microlens array substrate including a second plurality of microlenses 16 integrated along a second microlens surface and a second substrate surface opposite the second microlens surface (inherent), wherein the optical signals provided to the second plurality of individual optical fibers are each provided by a different one of the second plurality of integrated microlenses. Kadar-Kallen et al. suggests optical components for further light processing in the gap 22 between the end faces 4 and 14, but does not specifically disclose an optical chip coupled between the first microlens array substrate and the second

microlens array substrate, the optical chip including a first chip surface and a second chip surface.

6. Pan discloses an arrayed in-line optical device comprising an optical chip (an optical isolator chip) coupled between a first fiber array and a second fiber array. It would have been obvious to one having ordinary skill in the art to provide the optical chip of Pan into the gap of Kadar-Kallen et al. as suggested by Kadar-Kallen et al. for further light beam processing. The chip inherently comprises a first chip surface and a second chip surface.

7. Regarding claim 2, Kadar-Kallen et al. does not specifically disclose the first and second fiber array blocks and the first and second microlens array substrates to be made of materials with substantially similar coefficients of thermal expansion. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use materials having similar coefficients of thermal expansion since it was known in the art that using materials having similar coefficients of thermal expansion reduce thermal stresses on the device.

8. Regarding claims 3, Kadar-Kallen et al. suggests that an optical chip be disposed in the gap 22, therefore, the optical chip would, as a result, be coupled between the first and second microlens surfaces.

9. Regarding claim 4, see column 4, lines 48-50.

10. Regarding claim 5, see Figures 1 and 3.

11. Regarding claims 6 and 16, the end faces 4 and 14 are polished at an angle of 9°. Thus, since the end face of the microlens array substrate is clearly shown to be parallel to the end face 4 or 14, the microlenses (and microlens surfaces) are also tilted to the optical axis that passes through the microlenses at an angle of 9°. See Figure 1, and column 4, lines 1-11.

12. Regarding claim 7, Pan discloses the optical chip surfaces to have a corresponding angle to the surfaces of the component adjacent to the optical chip. Therefore, it would have been obvious to one having ordinary skill in the art to angle the surfaces of the optical chip to correspond to that (9°) of the collimator arrays of Kadar-Kallen et al.

13. Regarding claim 8, Kadar-Kallen et al. discloses holographic optical elements or HOEs (i.e. diffractive lenses).

14. Regarding claim 9, discloses an index matched optical adhesive for coupling the substrate to the block (see sentence spanning columns 5 and 6).

15. Regarding claims 10 and 11, a spacer 35 or 45 is disclosed. It would have been obvious to one having ordinary skill in the art to couple the optical chip between the spacers 35 and 45 to maintain the air gap such that the HOEs of Kadar-Kallen et al. would not be damaged by the optical chip.

16. Regarding claims 14 and 15, the pitch of the microlenses are disclosed in column 5, lines 11-13.

17. Regarding claims 17 and 18, Pan discloses an optical isolator chip comprising a first and second birefringent crystal plates 15 and 17, and a garnet 16. Pan does not specifically disclose a half-wave plate. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a half-wave plate since it was known in the art that conventional optical isolators comprise half-wave plates.

18. Regarding claim 19, see spacers 35 (and 45) in Figure 3 (and Figures 6 and 7).

19. Regarding claim 20, fiber array blocks and microlens substrates of the materials having substantially similar CTEs would have been obvious for the reasons stated in Paragraph 7 above.

20. Regarding claim 24, it is noted that the optical axis through the optical chip would be the same as the optical axis that passes through the microlenses. Additionally, the angle of the surfaces would have been obvious as stated in Paragraph 11 above.

21. Regarding claim 29, diffractive lenses are disclosed as stated in Paragraph 13 above.

22. Regarding claims 32 and 33, the pitch of the microlenses are disclosed as stated in Paragraph 16 above.

23. Regarding claims 35 and 36, an optical isolator chip is disclosed or suggested as stated in Paragraph 17 above.

24. Regarding claims 37-47, 50-56, 60, 65, 68, 69, 71 and 72, the method of merely providing the disclosed structural features is inherent; likewise, the method of merely providing the structural features that would have been obvious as discussed above would have been obvious for the same reasons.

25. Regarding claim 73, Pan discloses laser sources (i.e. light source modules) in column 1, lines 9-12; neither Kadar-Kallen et al. nor Pan additionally discloses a light receiver module. However, all optical devices are coupled between a light source module and a light receiver module. Therefore, the light receiver module would have been obvious to one having ordinary skill in the art.

26. **Claims 12, 13, 21-23, 48, 49 and 57-59, are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. in view of Pan as applied to claim 3, 9, 19, 39, 45 or 55 as applicable above, and further in view of Steinberg et al. (U.S. Patent Application Publication 2003/0138210).** Regarding claims 12 and 13, Kadar-Kallen et al. does not specifically disclose an AR coating on one of the microlens surface and the chip surface.

Steinberg et al. discloses an AR coating deposited over the microlens surface to minimize back reflections. See Paragraph [0026]. It would have been obvious to one having ordinary skill in the art to provide an AR coating on the first and second microlens surfaces to minimize back reflections. Furthermore, Kadar-Kallen et al. discloses index-matched adhesives for coupling optical components. It would have been obvious to secure the optical chip to the microlens surfaces by an index-matched adhesive to secure the chip as well as to minimize any surface irregularities between the coupling surface. See sentence spanning columns 5 and 6 of Kadar-Kallen et al. Furthermore, regarding claim 13, although an AR coating is not specifically disclosed for the first substrate or block surface, it would have been obvious to one having ordinary skill in the art since AR coatings are known to minimize back reflections at any coupling surface.

27. Regarding claims 21, Kadar-Kallen et al. does not specifically disclose a spacer and coupling arrangement of claim 21. Steinberg et al. discloses a spacer 29 having a first front surface and first back surface, the first plurality of optical fiber symmetrically positioned in a coupled surface formed by the first block surface and the first front surface, the first plurality of microlenses symmetrically positioned in a coupled surface formed by the first back surface and the first microlens array substrate. See Paragraph [0017]. The arrangement of Steinberg et al. would have been obvious to provide an output having low back-reflections. Similarly, a second spacer for the second collimator array would have also been obvious for the same reasons.

28. Regarding claim 22, Kadar-Kallen et al. does not specifically disclose an index-matched spacer. Steinberg et al. discloses a spacer block 29 that is index-matched with the cores of the optical fibers for low back-reflections. See Paragraph [0016]. It would have been obvious to

one having ordinary skill in the art to provide the index-matched spacer of Steinberg et al. in the device of Kadar-Kallen et al. to provide an arrangement exhibiting low back-reflections and to minimize unwanted bending of the optical path, as taught by Steinberg et al., at the fiber array block/spacer as well as the spacer/microlens array substrate interfaces or Kadar-Kallen et al., See also Paragraph [0021].

29. Regarding claim 23, neither Kadar-Kallen et al. nor Steinberg et al. specifically discloses the refractive index of the spacer 29 to be additionally matched with that of the microlenses. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide spacer having the refractive index substantially similar to that of the microlenses to provide an arrangement exhibiting low back-reflections and to minimize unwanted bending of the optical path.

30. Regarding claims 48, 49 and 57-59, the method of merely providing the disclosed structural features is inherent; likewise, the method of merely providing the structural features that would have been obvious as discussed above would have been obvious for the same reasons.

31. **Claims 25-28, 31, 34, 61-64, 67 and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. in view of Pan as applied to claim 24 or 19 as applicable above, and further in view of Ota et al. (U.S. Patent 5,446,815).** Kadar-Kallen et al. discloses a spacer comprising a first slanted surface coupled to the first block surface. Neither Kadar-Kallen et al. nor Pan discloses a spacer comprising a first back surface opposite the first slanted surface wherein the first slanted surface is coupled to the first block surface and the first back surface is coupled to the first microlens surface. Ota et al. discloses a spacer 21 comprising a first back surface opposite the surface coupled to the fiber block. The back surface of spacer

21 is coupled to the first microlens surface. The space additionally includes a first hole 22 such that optical signals provided by the first plurality of fibers pass only through air before encountering one of the first plurality of microlenses 13. See Figure 5. It would have been obvious to one having ordinary skill in the art to provide the spacer arrangement of Ota et al. in the device of Kadar-Kallen et al. to provide a precise spacing for optimized coupling between the fiber end faces and the microlenses.

32. Regarding claim 27 and 34, Ota et al. does not specifically disclose a slanted surface of the spacer. However, the slanted surface of the spacer would have been obvious to one having ordinary skill in the art at the time the invention was made in order to couple with the angle of the block surface while maintaining the optical path to the microlenses. Furthermore, Kadar-Kallen et al. discloses angles of 9° to minimize back reflections, as discussed above in Paragraph 11.

33. Regarding claim 28, a hole 22 is disclosed by Ota et al. as stated in Paragraph 30 above.

34. Regarding claims 31, neither Kadar-Kallen et al. discloses index-matched adhesives (column 5, lines 65-67), however neither Kadar-Kallen et al. nor Ota et al. discloses an index-matched spacer. However, index-matched spacers are known in the art and would have been obvious to inhibit spurious reflections at the interfaces.

35. Regarding claims 61-64, 67 and 70, the method of merely providing the disclosed structural features is inherent; likewise, the method of merely providing the structural features that would have been obvious as discussed above would have been obvious for the same reasons.

36. **Claims 30 and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. in view of Pan as applied to claim 19 or 55 as applicable above, and**

further in view of Duck et al. (U.S. Patent 5,701,375). Neither Kadar-Kallen et al. nor Pan discloses a first and second index-matched spacer element having a first/second inclined surface coupled to the first/second chip surface, and a first/second perpendicular surface opposite the inclined surface coupled to the first/second microlens array substrate. Duck et al. discloses two spacer elements (optical chip spacers) flanking an optical element 44. See column 5, lines 43-44 and column 6, lines 2-3. The spacer elements aid in maintaining the proper spacing between the optical element 44 and the fiber/collimator arrangement. Index-matched blocks are also well known in the art for preventing spurious reflections at coupling interfaces. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide first and second index matched spacers to maintain the proper coupling distances between the optical chip of Pan and the optical fiber/collimator arrays of Kadar-Kallen et al. Furthermore, since the first and second optical chip surfaces of Pan are inclined, it would have been obvious to provide an inclined surface of the index-matched spacer for mutual coupling with the inclined surface of the optical chip surfaces, wherein the surfaces are inclined at the same angle (i.e. 9°). Finally, the spacers 35 and 45 of Kadar-Kallen et al. provide perpendicular coupling surfaces. Therefore, it would have been obvious to one having ordinary skill in the art to provide perpendicular surfaces opposite the inclined surfaces of the optical chip spacers for mutual coupling with the perpendicular surfaces of the spacers 35 and 45 of Kadar-Kallen et al. and thus providing an optical arrangement with the desired optical path from the input to the output as shown in Figure 1 of Kadar-Kallen et al.

37. Regarding claim 66, the method of merely providing the structural features that would have been obvious as discussed above would have been obvious for the same reasons.

38. **Claims 74, 77 and 78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. in view of Pan as applied to claim 73 as applicable above, and further in view of Major, Jr. (U.S. Patent 6,122,303).** Neither Kadar-Kallen et al. nor Pan discloses an optical amplifier coupled between the light source module and the arrayed device or between the arrayed device and the light receiver module. Major discloses an optical amplifier coupled between source and receiver modules 10 and 20 for amplifying a degraded optical signal (column 4, lines 34-38). Therefore, an optical amplifier coupled with the arrayed device would have been obvious to one having ordinary skill in the art for amplifying a weakened or degraded optical signal.

39. **Claims 75, 77 and 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. in view of Pan as applied to claim 73 as applicable above, and further in view of Mukasa (U.S. Patent 6,470,126).** Neither Kadar-Kallen et al. nor Pan discloses a dispersion compensating module coupled between the light source module and the arrayed device or between the arrayed device and the light receiver module. The arrayed device comprises single mode fibers, which are known to exhibit chromatic dispersion. Mukasa discloses a dispersion compensating module for compensating for chromatic dispersion in such positive dispersion fibers (see abstract). Therefore, it would have been obvious to one having ordinary skill in the art for compensating for the positive dispersion of the single mode fibers of Kadar-Kallen et al. or Pan.

40. **Claims 76, 77 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadar-Kallen et al. in view of Pan as applied to claim 73 as applicable above, and further in view of Dultz et al. (U.S. Patent 6,282,333).** Neither Kadar-Kallen et al. nor Pan discloses a

polarization compensation module coupled between the light source module and the arrayed device or between the arrayed device and the light receiver module. Dultz et al. discloses a polarization compensation module. It would have been obvious to couple a polarization compensation module between the light source module and the arrayed device or between the arrayed device and the light receiver module to minimize polarization dependent loss.

Conclusion

41. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

42. Any inquiry concerning the merits of this communication should be directed to Examiner Sarah Song at telephone number 703-306-5799. Any inquiry of a general or clerical nature, or relating to the status of this application or proceeding should be directed to the receptionist at telephone number 703-308-0956 or to the technical support staff supervisor at telephone number 703-308-3072.

Sarah U Song
sus

John D. Lee
John D. Lee
Primary Examiner